



**PHOTO 9 - CURVE SIGNS/CHEVRONS/SIGHT RAILS**

Typical severe curve treatment. No advisory speed plate, two bar chevron, sight rail too short.

#### **4.16.6 Sight Rails**

Prior to the inspections the team had an expectation that there would be substantial use of sight rail where the cost of guardrail could not be justified. However, very few sight rails were installed either as additional curve delineation or nominal side protection. RTS5 states that 'for those situations where guard rails are uneconomic or conventional delineation devices do not provide the visual guidance expected, it is recommended that sight rails be constructed'.

#### ***Recommendation***

*That Transfund requires Road Controlling Authorities to generally adhere to the RTS5 guideline for delineation. This issue is also covered in Section 3.5 Post Construction Safety Audits and Section 4.7: Signage .*

#### 4.17 Guard Railing

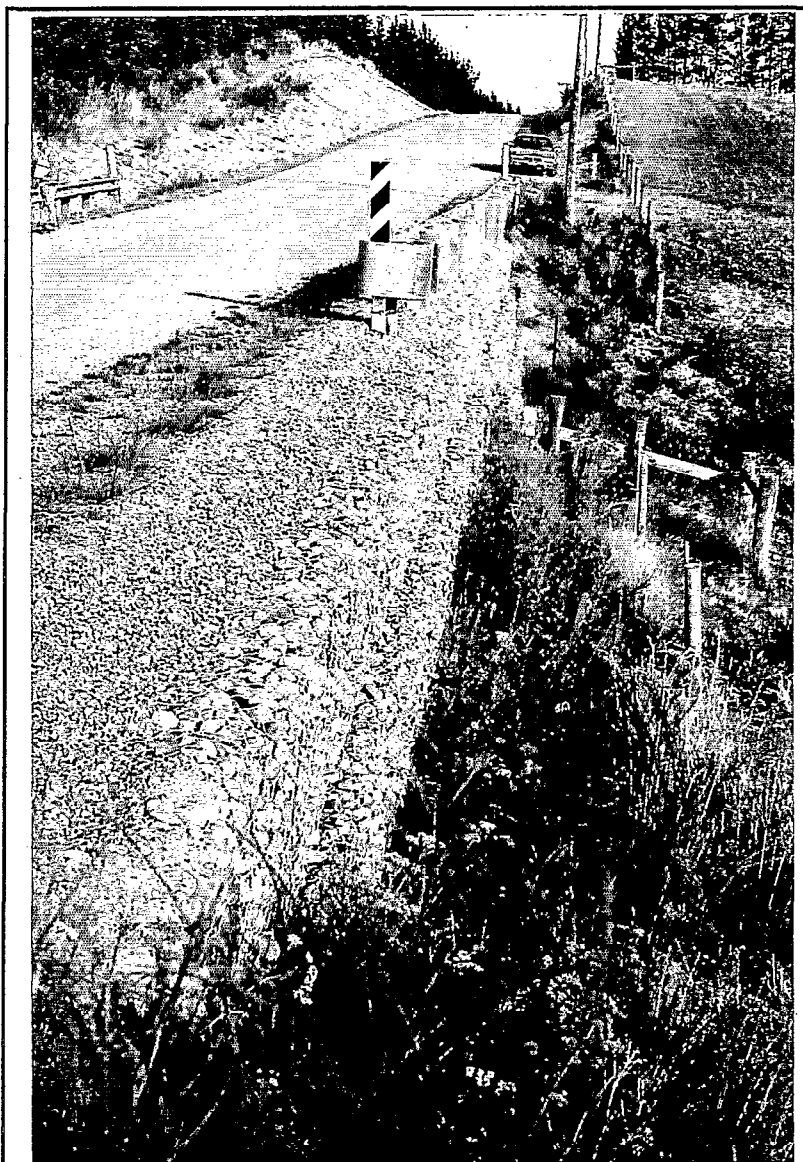
Several unsafe and poor examples of guard rail were identified. In a number cases it was considered the guard rails could not possibly achieve the intended purpose due to the manner in which they were installed. They were little more than an expensive sight rail.

Guard rail installations must be designed with the intention of fully restraining errant vehicles. The required lateral resistance to impact is dependent on the ribbon affect of the guard rail and requires adequate anchorage systems and competent placement of the intermediate posts.

The following structurally unsound practices/poor installations were noted:

- Posts installed on top of gabion walls within the top gabion basket.
- Situations where the finished level of the tops of gabion walls were up to 400-500mm below seal level. Timber planks had been placed on top of the gabion walls against the guard rail posts to retain the metal shoulder. This effectively increased the length of the post and the 'lever arm' from the standard 550mm to 950-1050mm above seal level significantly reducing the lateral resistance.
- Splice joints with bolts missing, or fitted but not through both rails.
- Through bolts in poorly aligned holes drilled as close as 30mm to the edge of the post.
- Posts not physically connected to rails or had un-nutted and non-standard through bolts.
- Timber posts as small as 100mm x 100mm. These were often located close to the most likely section of guard rail to be struck.
- Posts with little or no ground embedment.
- Bridge Breakaway Cable Terminals (BCT's) with two cables instead of the standard three.
- BCTs with blockouts (200mm x 150mm timber spacers used on the guard rail but not on BCT's).
- BCTs with very slack and ill-fitting lower cable assemblies.
- No clear width was provided behind BCT's.
- Rail, terminal units and posts damaged and in need of repair or replacement.

The engineering and dynamics of guard railing needs to be fully understood. Guard railing needs adequate footings/ anchorage to function correctly. The team was concerned that there is a general lack of expertise in this area. Guard railing is expensive and requires proper design and installation to ensure it will serve its intended purpose.



**PHOTO 10 - GUARD RAILING**

Note the guard rail posts are embedded in a gabion wall. The guardrail lacks sound anchorage and lateral restraint, has no flares and ends well short of the extent of the retaining wall.

### ***Recommendations***

*That Transfund require Road Controlling Authorities to undertake safety inspections of all guardrails to ensure that they are correctly installed.*

*That Transfund encourage Road Controlling Authorities/Consultants to provide additional training on the design and installation of guard railing.*

#### **4.18 Road Failures (Dropouts)**

On many projects significant dropouts had either occurred or are likely to occur. There was evidence of a lack of geotechnical investigation and/or poor engineering. Failures were obviously left unrepaired for long periods of time. Warning signs and forms of protection were generally inadequate as these failures often occurred where visibility was poor. In many cases orange mesh was the only warning provided and this had frequently faded to almost white.



**PHOTO 11 - ROAD FAILURES**

Note poor delineation of dropout, also exposed steel rails.

### **Recommendations**

*That Transfund require Road Controlling Authorities to undertake adequate geotechnical investigations to minimise the risk of future dropouts. This issue is discussed further in Section: 3.3 Scheme Assessments/Application for funding and Section: 3.4.6 Seal Extension Maintenance Costs.*

*That Transfund require Road Controlling Authorities to ensure that adequate warning of failures is provided. If funding is not immediately available more permanent warnings/fencing should be put in place until repairs are completed.*

#### **4.19 Culvert End Structures**

There was little attention paid to safe treatment of culvert end structures. Many were very close to the edge of seal, unmarked or wrongly marked with marker posts, and often scouring/undermining of the seal had developed.



**PHOTO 12 - CULVERT END STRUCTURES**

Note the proximity of the recently constructed culvert head wall, also the lack of a sight rail/hazard marker.

On one project, the seal width was significantly narrowed locally to fit an existing culvert. This culvert was located just beyond a right hand curve with poor visibility and at the bottom of a long descent. There was no signage or sight rail to warn of the hazard. The cost of extending the culvert would not have been excessive.

**Recommendation**

*That Transfund require Road Controlling Authorities to ensure culvert end walls are not constructed dangerously close to the edge of seal on new projects. If possible, culverts should be constructed flush with a 3 to 1 fill batter. Structures should be designed to minimise damage to errant vehicles which leave the road. Ideally a 2m feather edge should be accommodated, however, it is acknowledged that this is not always practicable.*

**4.20 Side Drains**

A number of projects had side drains which appeared unnecessarily deep. This may have been as a result of the overlay/shape correction incorporated in the seal extensions. Many were on steep slopes and erosion/undermining of the edge support was occurring. One project had excessively deep side drains adjacent to the road. This was apparently related to difficulties in finding an outlet and problems with the landowner.

**Recommendation**

*Transfund should require Road Controlling Authorities to ensure that in general the depth of side drains not greater than that necessary to provide adequate drainage. Deep outlet drains should not be located adjacent to the highway.*

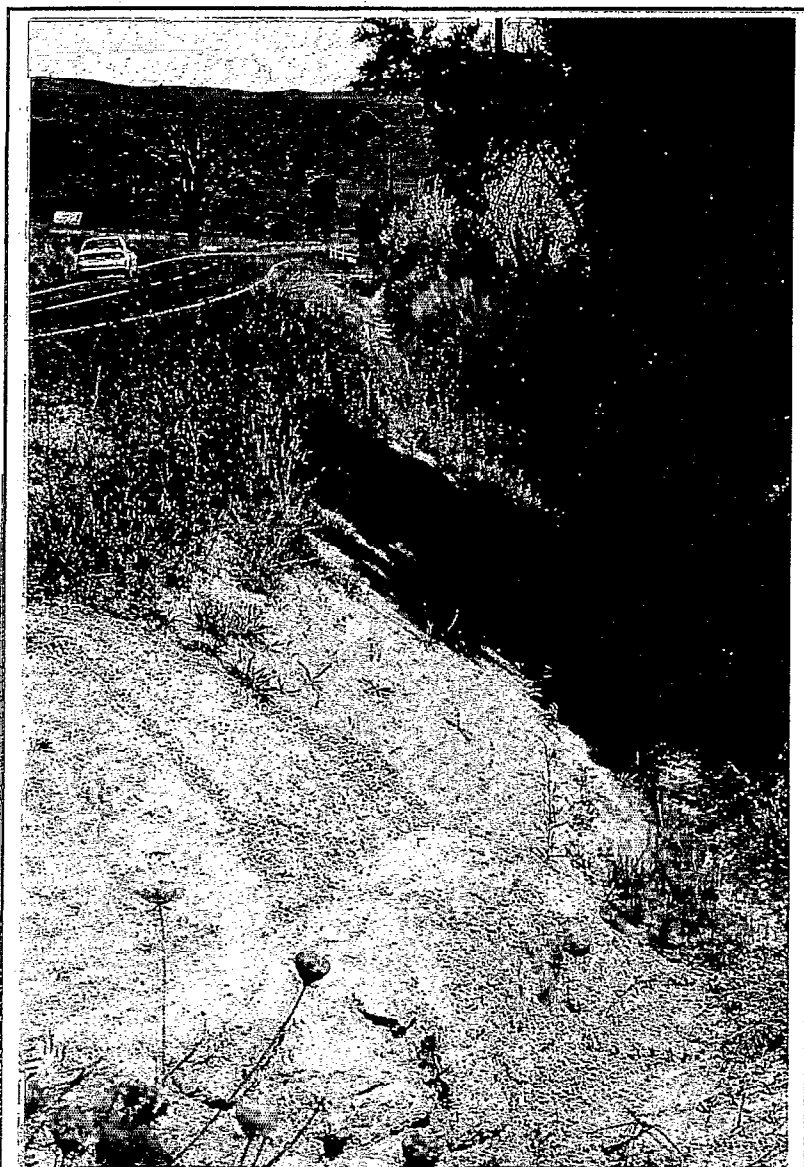


PHOTO 13 - SIDE DRAINS  
Note depth of adjacent side drain

#### 4.21 Deterioration of Road Surface

Several projects showed evidence of a deteriorating road surface and rapid loss of skid resistance. This was generally on tight curves with high traffic demand. The problem ranged from severe chip seal loss which in some cases had resulted in exposure of the base course, to sections of seal chip stripping.

**Recommendation**

*That Transfund require Road Controlling Authorities to review sealing methods for high demand areas and to ensure adequate maintenance to provide uniform skid resistance.*



PHOTO 14 - DETERIORATION OF SURFACE  
Note the bleeding, also to the left of the lane the basecourse is exposed.

**4.22 Loose Sealing Chip**

Sweeping of loose chip appeared to have low or no priority with many Road Controlling Authorities. In many cases it appeared the surface had never been swept. Of most concern was the volume of loose chip noted on horizontal curves where it is considered particularly unsafe.

**Recommendation**

*That Transfund require Roading Authorities to review road sweeping policies and to ensure the practice of failing to remove loose chip following sealing is eliminated.*

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PHOTO 15 - LOOSE SEALING CHIP

Note the sealing chip encroaching onto the lane, also the side road drainage is not being collected and flows across the highway.